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NOTES ON THE NATURAL HISTORY OF THE PIGMY PERCH

(*Nannoperca vittata*)

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INTRODUCTION

As far as the writer is aware, knowledge of the natural history of any of the fresh-water fishes of the South-west of Western Australia is a virtual blank and this article on the Pigmy Perch (*Nannoperca vittata*, Castlenau, 1873) is one of a series in which it is hoped to record the results of several years intermittent investigations on the subject.

Though the fishes of the South-west—the Vlaminghian fluvi-faunula of G. P. Whitley (1947) present some resemblance to those of south-eastern Australia (i.e. the same author's Lessonian fluvifaunula), by reason of climatic factors and geographical isolation, profound differences have developed and two of our genera, *Bostockia* and *Nannatherina*, occur nowhere else.

All the fishes native to this area are of small size, but nevertheless play their part in biological control of insect and other pests, whilst also, recent examination of stomachs of introduced Rainbow Trout from the waters near Roleystone and Pemberton has shown the Pigmy Perch to be a not inconsiderable item of its food.

Considerable confusion exists with regard to the taxonomy of the genus *Nannoperca* (Gunther, 1861) and of the present species, due to inexplicable errors in the original descriptions, and I hope later to submit a paper dealing with this matter. For the time being, however, I am accepting McCulloch's (1929) classification as the most recent catalogue of all known Australian fishes.

The fish has been illustrated by the late A. R. McCulloch (1912) but his figure shows an error in the length of the anal spines. An examination of the original drawing, kindly loaned by the Australian Museum, Sydney, showed the fault to have been caused by the block-maker or printer, the drawing being correct. As the length of the anal spines is used in a key to the species by Ogilby (1899) the fish is here re-figured from a living female (Fig. 1), McCulloch's figure being that of a male.

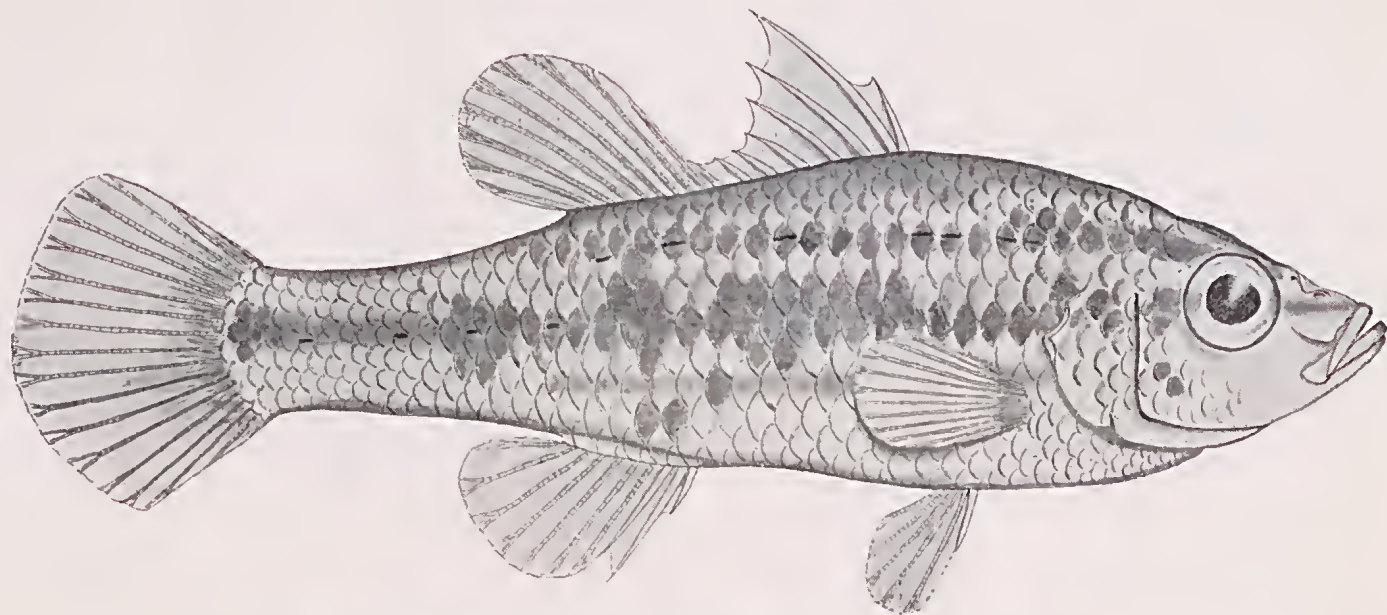


Fig. 1—Pigmy P perch (*Nannoperca vittata*); female specimen. x 3.

All illustrations by the author.

DISTRIBUTION AND HABITAT

The Pigmy Perch inhabits the coastal streams and swamps in the area shown shaded in the accompanying map (Fig. 2), the northern boundary being the Moore River and the south-eastern the Phillips River. The Western Australian Museum has specimens from the majority of streams in this area, and I am indebted to Dr. D. L. Serventy for the use of his field notes wherein he recorded the fish's occurrence in a number of small swamps and lakes in the vicinity of Perth. I have been unable to find the fish in the Hill River, the next northern-most stream from the Moore River, or in Jerdaeuttup Creek, east of the Phillips River, and would welcome any reports from places beyond the limits I have indicated.

The fish are able to tolerate some rise in salinity and live, for instance, in the highly saline parts of the Avon River at Northam in the summer months. In the Swan River system I have



Fig. 2—Distribution of the Pigmy Perch in Western Australia.

collected specimens as far downstream as Guildford (after the onset of the winter rains). In Bull's Creek they are found as far

as its mouth into the Canning River. There is considerable tolerance to temperature fluctuations. I have found the fish in natural waters where the temperature was as low as 35° F. (mid-winter, with ice forming on the edge of the water) and under temperature conditions as high as 90° F.

HABITS

Although only slightly gregarious in habit, the adults may be found in small schools of up to ten individuals swimming near the bottom of the stream or pond searching for their food, which consists mainly of caddis-fly larvae (Trichoptera). They will, however, occasionally make a quick dart to the surface to snap up any flying insect that has been unfortunate enough to fall into the water. The fry keep to the edges of the pools or streams and appear to prefer feeding along fairly steep banks. They are of a solitary nature and I have not yet seen them even in pairs.

The largest specimens examined have reached a total length (tip of the snout to the end of the rounded caudal fin) of 70 mm. (= 2¾ in.), the average size being 65 mm. (= 2½ in.) at three years. My previous observations, including aquaria studies, show that the species attains a length of 35.0-46.5 mm. at one year, 53.7-57.5 mm. at two years and 60-65 mm. at three years. Scale samples indicate a maximum life span of five years.

Specimens taken from the Perth area were found to be infested with parasitic nematodes lodged in the abdominal cavity. Professor T. Harvey Johnston, of the University of Adelaide, identified these for me as the larval stage of *Eustrongylides gadopsis*, the adult of which is believed to be carried by cormorants.

COLOUR

When seen in the water the fish appears to have dark brown lateral bands on a light background. On close examination the bands are found to be broken and the background a pale lemon colour on the area above the median line, grading to a pearly white on the ventral surfaces. During the breeding season the females, which are slightly larger than the males, develop a pale bluish tinge on their sides above the median line, retaining the pearly sheen below. In the males in their nuptial colouring the fins, with the exception of the pectorals which remain transparent, become almost black with a narrow clear border at their attached ends; the banded effect is more pronounced, and the sides assume a vivid orange. Sex may be determined at all times in the adult fish by the darker fins of the male.

SPAWNING STUDIES IN AQUARIA

Methods and Preliminary Observations

Early efforts to induce the fish to breed in a glass-sided aquarium were unsuccessful, the fish retreating to a corner and sulking, so when specimens were obtained early in 1946 from the lower Canning River they were placed in a circular 150-gallon

pond 18 inches deep. The pond was thickly planted with aquatic plants, *Vallisneria* and *Elodea*, and strewn with rocks and other inducements, as at this stage it was not known in what manner the eggs were deposited. From past experience of most fishes it was found that no reliance could be placed upon the habits of other species, even of the same genus, to predict spawning behaviour!

The fish in the pond were fed with a variety of live foods, including *Daphnia thomsoni*, mosquito larvae, chopped earthworms, etc., given at odd intervals.

Dissection of ripe females showed that only small numbers of eggs (40-50) could be expected. The average number of eggs in each ovary was found to be 20, ranging from 7 to 25, the numbers varying with the length of the fish. It was known, from field observations, that the breeding season extended from July to January or even later if the food supply was plentiful.

Although very young fish, 10-22 mm. in length, were seen in September 1946 in the Wooroloo Brook, no sign of any fry could be found in the pond until March 1947, when one, 10 mm. in length, was caught.

I was absent during June and July and on my return in August found the fish had spawned, there being upwards of 50 fry in the pond. Fifteen of these were caught (total lengths being 3-10 mm.) and transferred, together with a pair of adults, to a 50-gallon glass-sided aquarium, 3 ft. x 18 in. x 18 in. deep.

Difficulty was experienced in persuading them to accept dried food, so some young *Barbus conchoni* were introduced into the same tank and the Perch rapidly learnt from them to take this strange food. By the end of the year they had attained a total length of 20-25 mm. and had become quite used to the glass tank. The adult pair lost their shyness as well.

It was noted that the remainder of the fry in the pond had a similar growth rate. Their food consisted more of live insects etc., that bred in or fell into the pond.

Early in 1948 some Minnows (*Galaxias occidentalis*), Atherines (*Craterocephalus edelensis*) and Gobies (*Glossogobius suppositus*) were also placed in the tank as these fishes, with a few others, inhabit the same waters, and I wished to determine their attitude to the eggs and fry of the Pigmy Perch. A small roekery was placed in the tank and the top of this planted with willow moss (*Fontinalis*). The bottom was covered with two inches of coarse sand and planted with *Vallisneria*, *Aponogeton*, *Cryptocoryne* and *Ambulia*, to form a fairly dense thicket. A small amount of *Riccia* was floated on the surface.

Nuptial Display

At the end of July it was noted the fish were commencing to assume their breeding colours so the contents of the tank were re-arranged. The *Barbus conchoni* were removed and only six Perch, six Atherines, six Minnows and three Gobies were retained.

The Perch comprised two three-year-old fish (a male and a female) and two male and two female fish one year old. The plants were left undisturbed as by this time they had all made good growth. In the belief that it would speed up events so that they would occur during the period when I was able to watch the tank, the temperature was raised from 60-63° to 68-70° F.

An abundance of food, which consisted of *Daphnia* and Enehytraeid worms, brought the males into their full courting colours and they were observed to be displaying to the females, erecting all their fins to the maximum and moving in small eireles by a fairly rapid vibration of their bodies. This activity took place in the immediate vicinity and usually underneath, the females. The females, as is commonly the case in such displays, gave the impression of completely ignoring the males.

Spawning

The larger male became noticeably aggressive, chasing the smaller ones, and swimming around the central rockery appar-

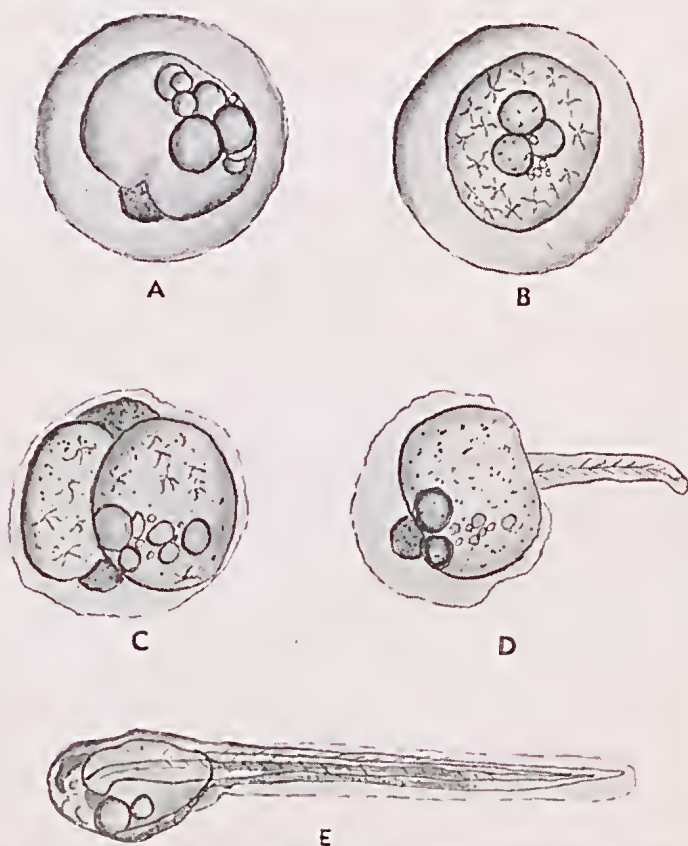


Fig. 3—Development of the Egg: A, egg at laying; B, 24 hours old; C, 48 hours old; D, larva emerging at 60 hours; E, larva at hatching, 62 hours after laying of egg. x 25.

ently with a critical eye. This procedure was kept up for a few days until August 3, when the large male, backed up by the two smaller ones, drove the biggest female up to the surface at the back of the tank. After what could only be described as a few seconds scramble, one egg was seen slowly descending through the water. This took place at 10 a.m. The egg was caught in a dip-tube and found to be 1.2 mm. in diameter. It was demersal and for 15-30 minutes after extrusion was adhesive. At 10-15 minute intervals the procedure was repeated, occasionally the fish entering the clump of *Fontinalis* and worming their way through. Spawning ceased at noon, after perhaps 8-10 eggs were laid. Further specimens of the eggs were collected and placed in a 4-inch Petri dish maintained at room temperature, 60-64° F.

Next day the same events were repeated, all the males driving one of the females and concentrating on her alone. The unoccupied females were seen to seize the eggs as they were dropped and eat them, even though the tank was kept well supplied with live *Daphnia*. One egg was extruded each time, rarely two, never more. In between the actual spawnings the larger male made valiant attempts to keep the other Perch away from the centre clump of *Fontinalis*. None of the males was seen to eat any of the eggs nor did any of the other species of fish in the tank. One egg was caught in the dip-tube, allowed to adhere half-way down, and the tube placed upright in the tank. The females soon noticed the egg and made repeated attempts to snap it up, making darts at the egg and glancing off the glass tube on each occasion. After about half an hour they evidently realised the futility of their efforts and made no further attempts.

It was noted that the eggs were always extruded while the fish were at the surface of the water, and less than half were laid in the comparative safety of the *Fontinalis*.

No further egg laying took place after a week of spawning, during which approximately 60 eggs were deposited by the older female and less than 20 by each of the younger ones. The actual egg-laying took place only between the hours of 10 a.m. and noon each day.

Spawning of individual females appears to be resumed at 6 to 8 week intervals, and, from previous observations, such spawning periods continue throughout the breeding season. Also from previous observations it was found that fishes of both sexes reached maturity at the end of their first year.

Development of the Egg

At extrusion the eggs were transparent with a slight yellowish protrusion from one side. A fairly large perivitelline space separated the yolk from the enclosing envelope, and numerous oil globules were present (Fig. 3, A). Twenty-four hours after extrusion a change was noticeable in the eggs, slight pigmentation occurring (Fig. 3, B). At forty-eight hours the embryo had almost filled the envelope, the head and tail starting to appear (Fig. 3, C),

wrapped around the yolk sac. At sixty hours the tail burst through the envelope (Fig. 3, D) and shortly after cast it off, and the larva was free (Fig. 3, E). The time of hatching varied slightly from 62 to 74 hours at a temperature of 60° to 64° F. A rise of 10° F. made no apparent difference. About 25% of the eggs proved infertile.

Larval Development

The larvae on hatching were extremely primitive, for a pereiform, eyes being barely discernable but without any pigmentation; without a mouth; no vent, and only very lightly pigmented with small melanophores. They were capable of quite rapid swimming and would make off if touched with any object. The heart, very light red in colour, beat 112 to 114 times per minute, and the course of the almost transparent blood was easily traced along the notochord, returning on the ventral side around the oil globules to the heart. The diameter of the eggs varied from 1.1 to 1.2 mm. and the total length of the newly hatched larvae was from 3.0-3.2 mm. At one day old the average length of the larvae was 3.6 mm. and the several oil globules had fused into one, the eyes becoming more apparent but were still without pigmentation until the larvae



Fig. 4—Larva at 2 weeks. x 15.

were three days old. At this age the swim bladder commenced to make its appearance. Five days after hatching the mouth became visible, ventrally situated immediately under the eye. At one week old the larvae had reached a length of 5 mm. the mouth opened, respiration at the rate of 35 to 36 times per minute commenced, and the little fish swam in an upright position when touched. At two weeks, when the larvae had reached a total length of 6.4 mm. pigmentation was fairly pronounced, the pectorals were seen to be formed and moving rapidly, the yolk sac had been absorbed, and they were now entering the post-larval stage (Fig. 4).

At this date larvae were discovered in the control pond. Examination showed these to be of the same stage of development as the

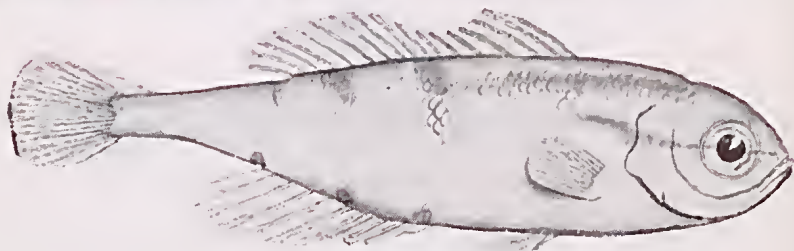


Fig. 5—Fry 1 month old. x 4.

ones under observation in the aquarium so that the artificial rise in temperature in the tank could have been of no significance.

At the age of one month the fish, which had attained a length of 24.7 mm., commenced to develop visible scales and began to assume the colour pattern of the adults. The rays and spines were appearing in the fins and the position of the swim bladder was visible as a translucent patch on the side of the fish near the pectoral fins (Fig. 5). From this stage onwards they resembled the adults in appearance and behaviour.

SUMMARY

The Pigmy Perch (*Nannoperca vittata*) inhabits coastal streams and marshes in south-western Australia in the area bounded on the north by the Moore River and on the east by the Phillips River. It occurs in fresh and brackish waters amongst stones and other debris with a preference for clear water. It is entirely carnivorous, feeding on insects, mainly caddis-fly larvae (Trichoptera). The fish is of peaceful disposition and swims in leisurely manner near the bottom. It is hardy and suitable as an aquarium species. It withstands a temperature range of 35°-90° F.

The size and growth rate is as follows:—1 year, 35.0-46.5 mm. (= 1½ in.) in total length; 2 years, 53.7-57.5 mm. (= 1¾ in.); 3 years, 63 mm. (= 2½ in.); 4-5 years, 70 mm. (= 3 in.).

Sexual characteristics: The fins, except the pectorals, are darker in the male, becoming almost black in the breeding season when the male also has orange sides.

The eggs are 1.1 to 1.2 mm. in diameter, demersal and adhesive. They are deposited at the surface in ones and twos each morning until 20-50 have been laid over a period of 5-7 days. Spawning continues at 6-8 week intervals from July to February. Hatching occurs after 60-72 hours at 60°-70° F. The larval stage takes 2-3 weeks. The fish mature at 1 year.

REFERENCES

- Gunther, *Proc. Zoo. Soc. London*, May 1, 1861, p. 116.
Castelnau, *Proc. Zool. Acclim. Soc. Vict.*, vol. ii, May 10, 1873, p. 123.
Ogilby, *Proc. Linn. Soc. N.S.W.*, vol. xxiv, 1899, p. 175.
McCulloch, *Rec. W.A. Mus.*, vol. i, pt. ii, 1912, p. 85, pl. x, fig. 2.
McCulloch, "A Check List of the Fishes Recorded from Australia," *Aust. Mus. Memoir*, v, 1929, p. 156.
Whitley, *W.A. Naturalist*, vol. i, no. 3, Dec. 15, 1947, p. 52.